Problem 1-6

At what wavelength does the maximum in the radiant energy density distribution function for a blackbody occur if (a) $T = 300$ K? (b) $T = 3000$ K? (c) $T = 10\,000$ K?

Solution

According to the Wien displacement law,

$$\lambda_{\text{max}} T = 2.90 \times 10^{-3}\ \text{m} \cdot \text{K}.$$

Solve for λ_{max}.

$$\lambda_{\text{max}} = \frac{2.90 \times 10^{-3}\ \text{m} \cdot \text{K}}{T}$$

If $T = 300$ K, then

$$\lambda_{\text{max}} \approx \frac{2.90 \times 10^{-3}\ \text{m} \cdot \cancel{\text{K}}}{300\ \cancel{\text{K}}} \approx 9.67 \times 10^{-6}\ \text{m}.$$

If $T = 3000$ K, then

$$\lambda_{\text{max}} \approx \frac{2.90 \times 10^{-3}\ \text{m} \cdot \cancel{\text{K}}}{3000\ \cancel{\text{K}}} \approx 9.67 \times 10^{-7}\ \text{m}.$$

If $T = 10\,000$ K, then

$$\lambda_{\text{max}} \approx \frac{2.90 \times 10^{-3}\ \text{m} \cdot \cancel{\text{K}}}{10\,000\ \cancel{\text{K}}} = 2.90 \times 10^{-7}\ \text{m}.$$